联想凌拓
轻松实现容器配置的持久存储
— 您的工作方式您做主

第二期：
容器技术、应用介绍与在线演示

胡晓明 | 张培伟

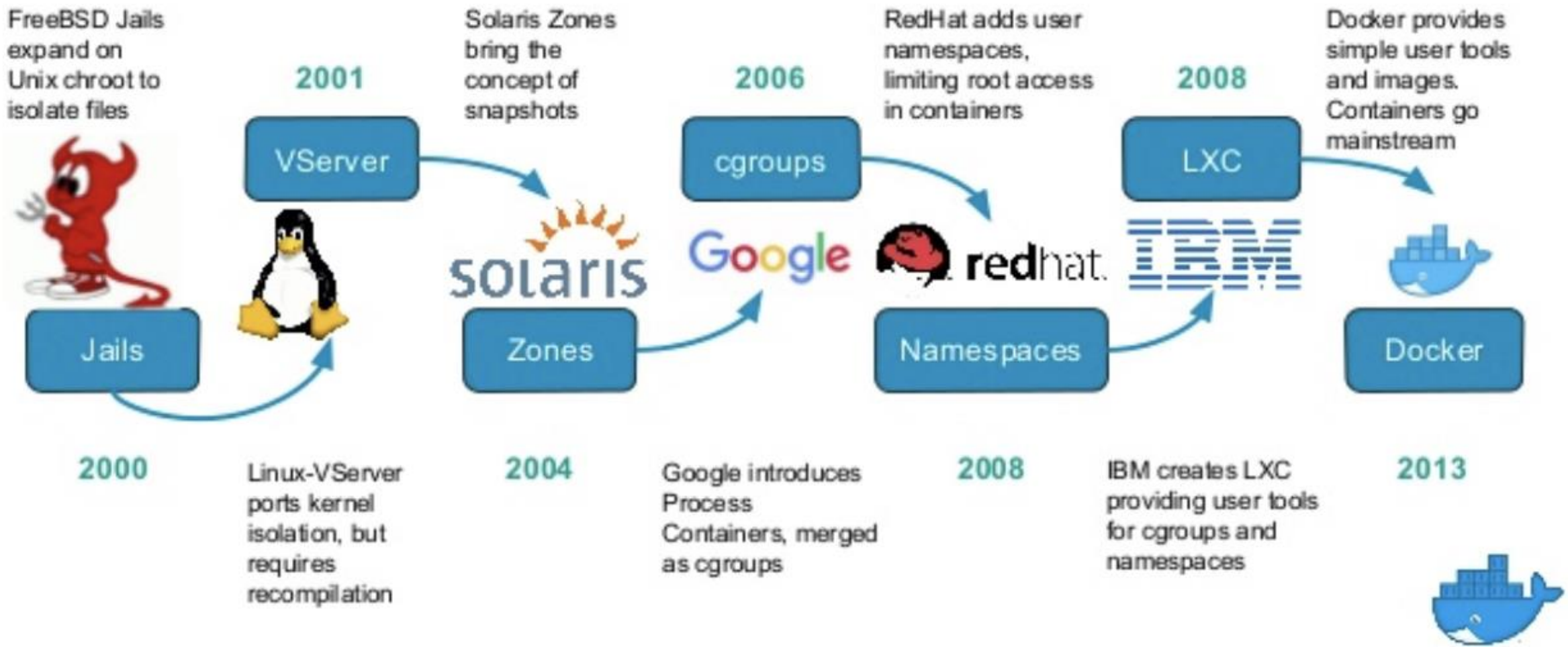
第一部分　容器技术介绍与容器存储需求分析

第二部分　联想凌拓Trident解决方案

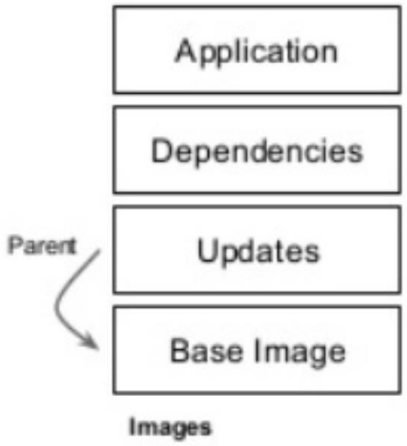
第三部分　容器技术解决方案客户案例

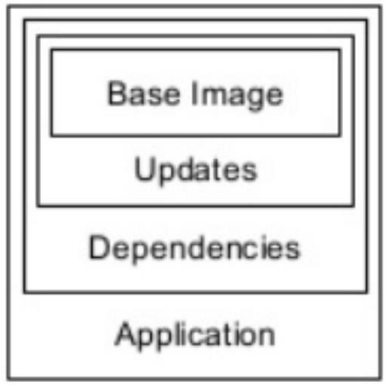
第四部分　容器技术在线演示

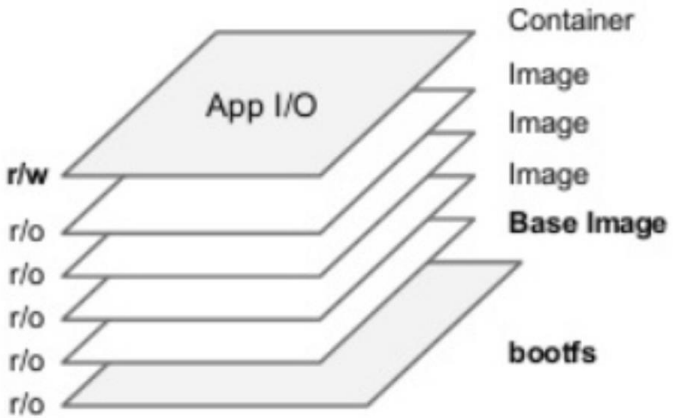
容器技术发展历程

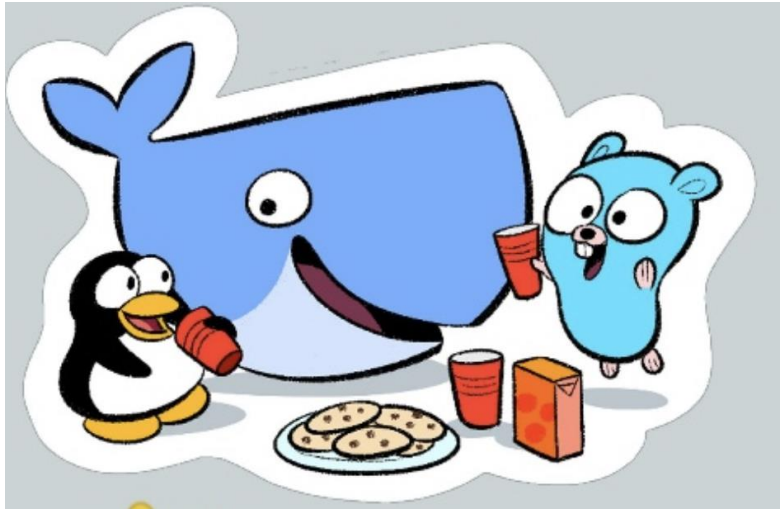


容器与Docker

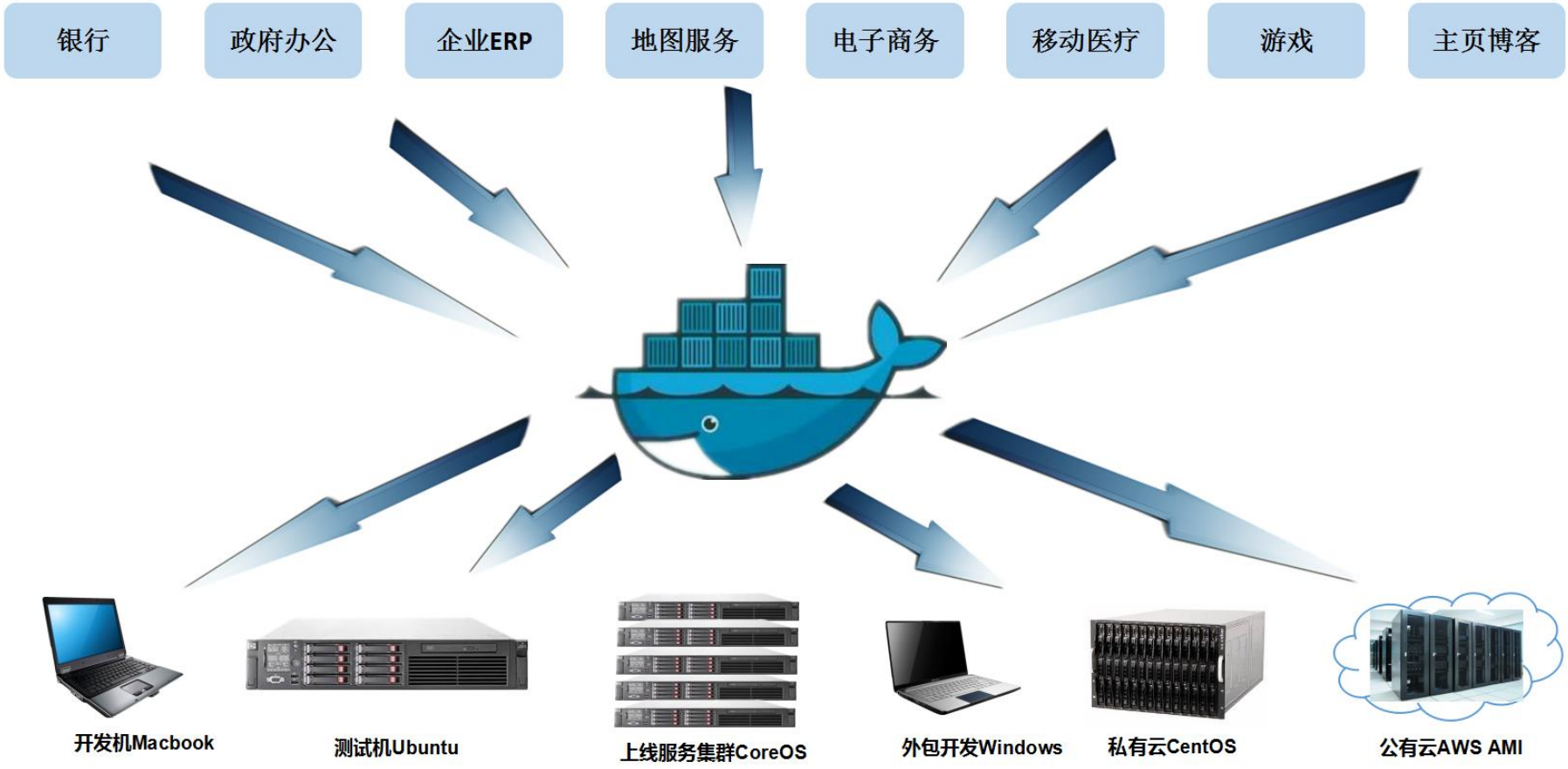




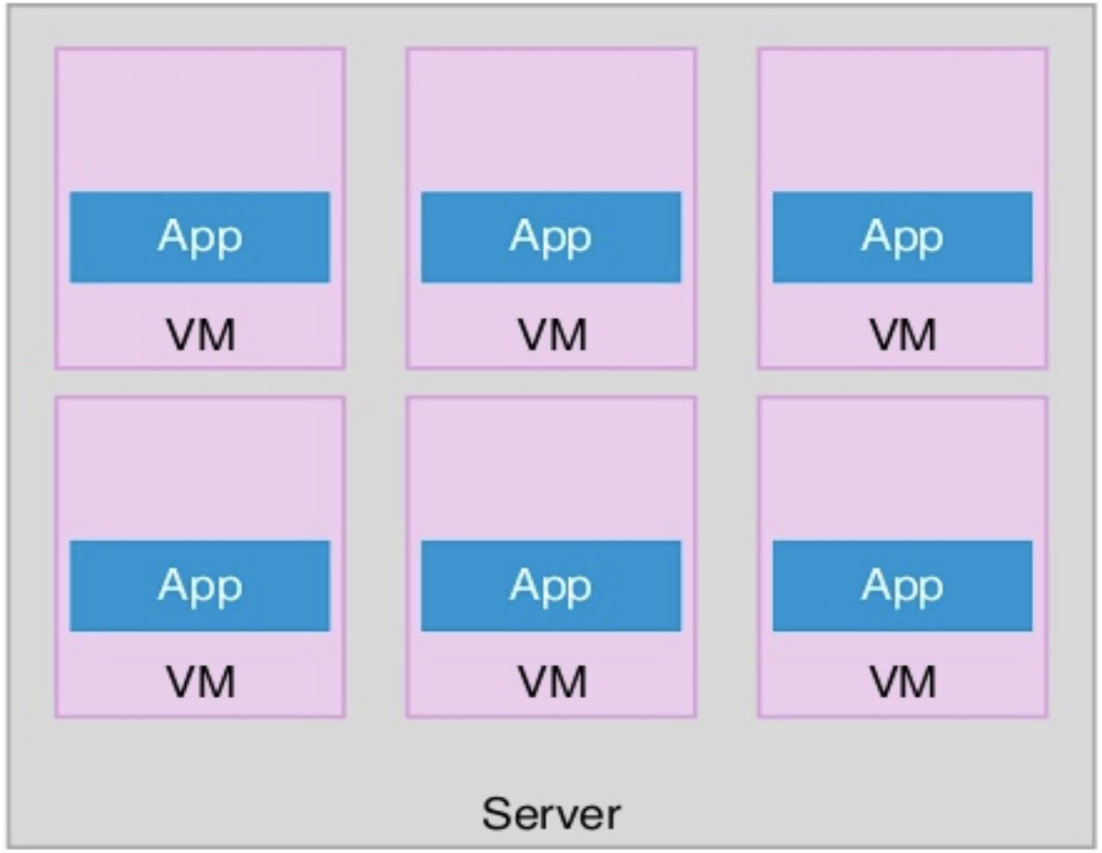


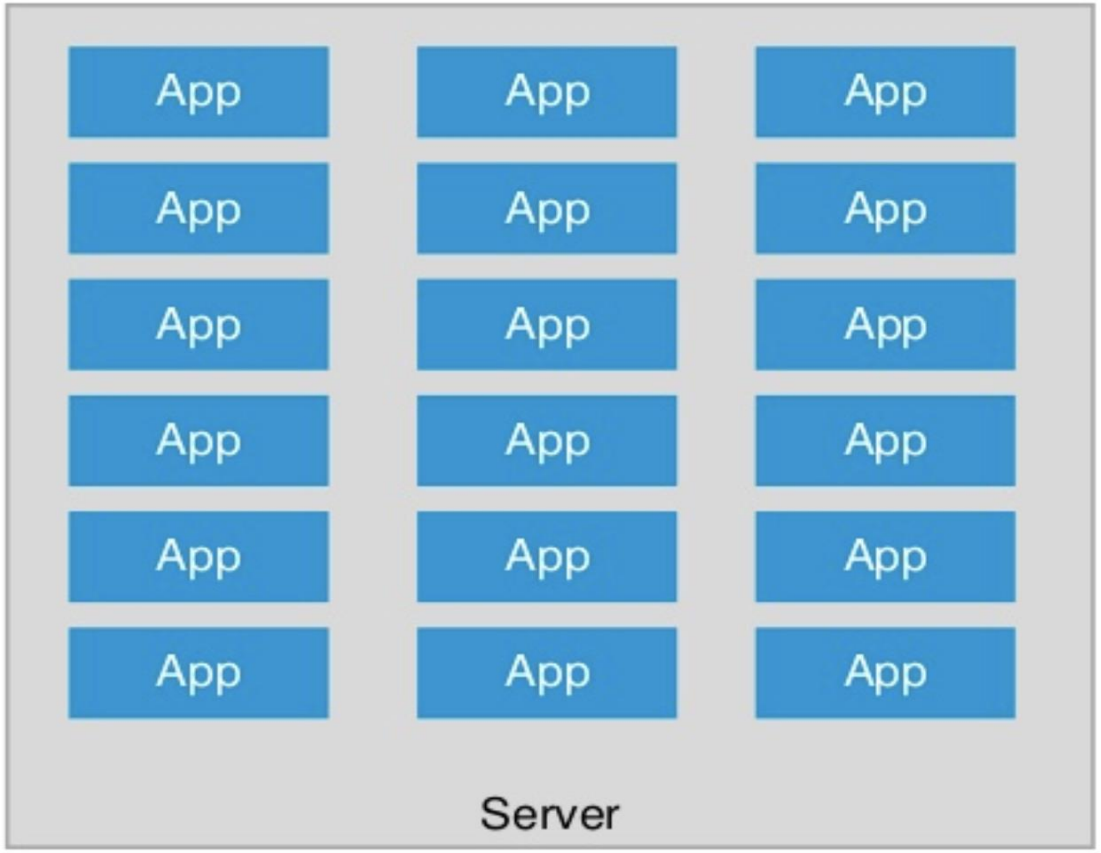


容器技术优势和应用场景



容器比传统虚拟化的优势



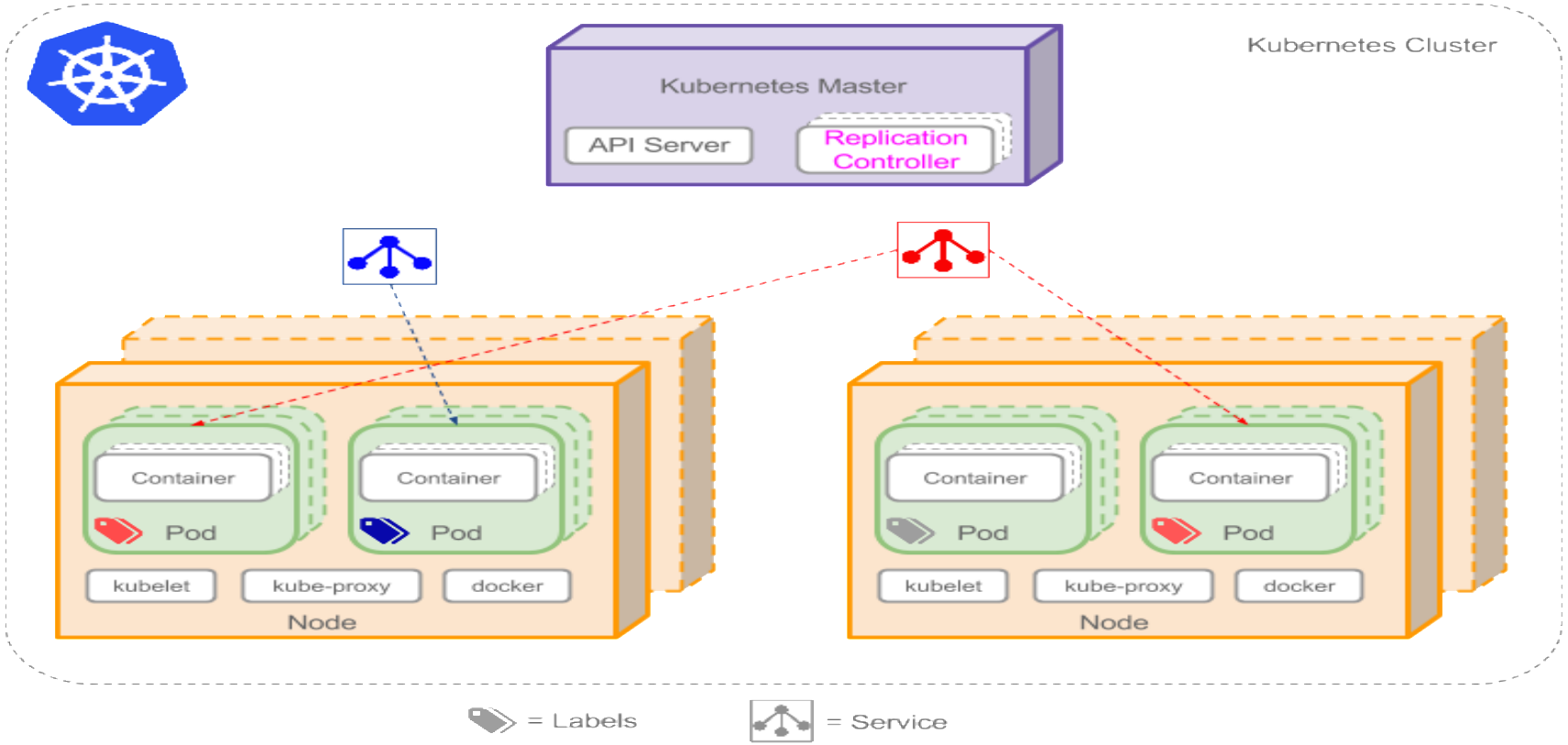


性能对比

特性	容器	虚拟机
启动	秒级	分钟级
硬盘使用	一般为 MB	一般为 GB
性能	接近原生	弱于
系统支持量	单机支持上千个容器	一般几十个

- 备注:
  - 成百上千个容器管理是个难题
  - K8S – 2014诞生

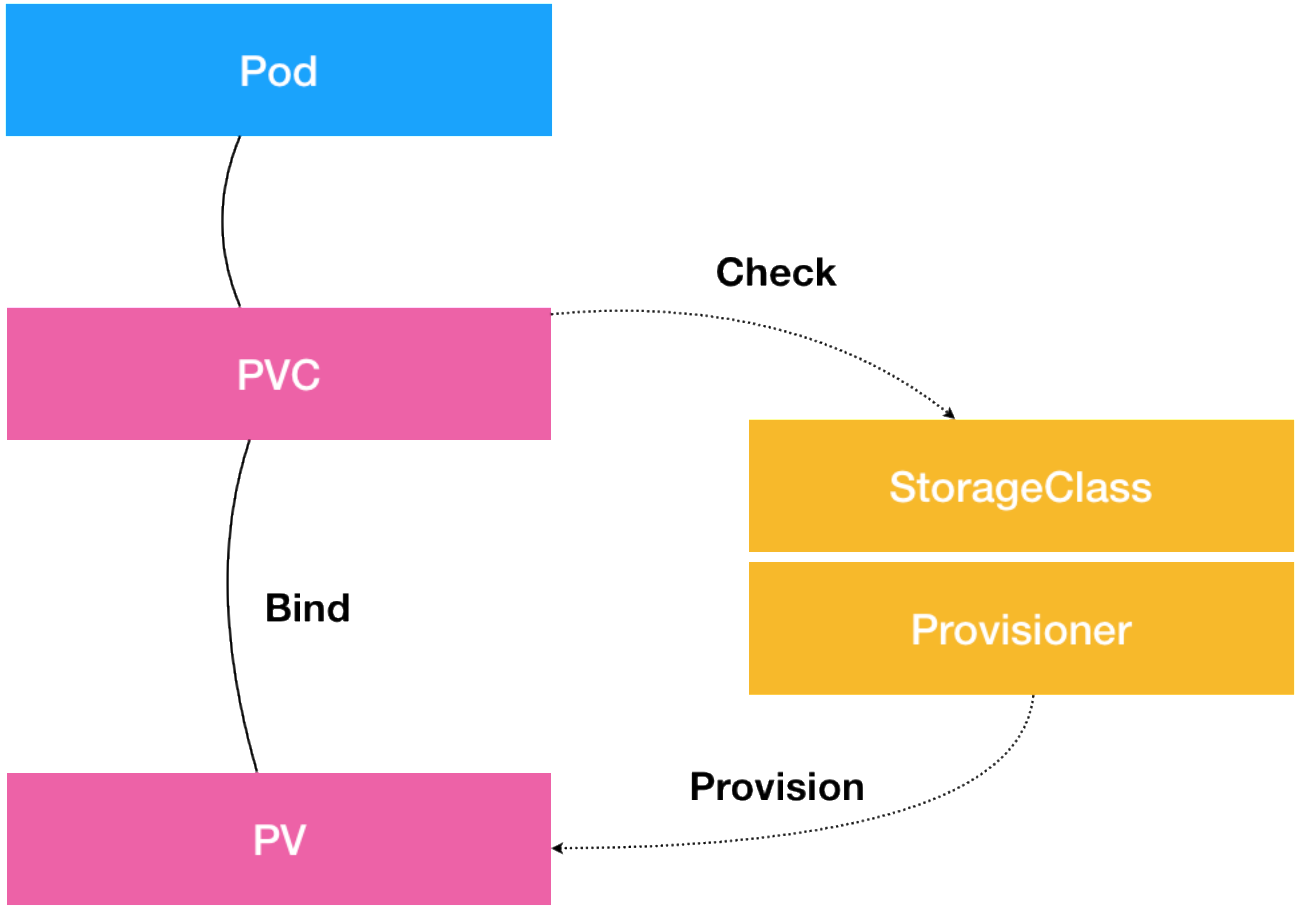
容器编排技术



- 自动化容器的部署和复制
- 随时扩展或收缩容器规模
- 将容器组织成组，提供容器间的负载均衡
- 升级应用程序容器的新版本
- 提供容器弹性，替换失效容器

Kubernets 成为事实的标准

容器环境对存储管理的挑战



Persistent Volume Claim（PVC）

Persistent Volume（PV）

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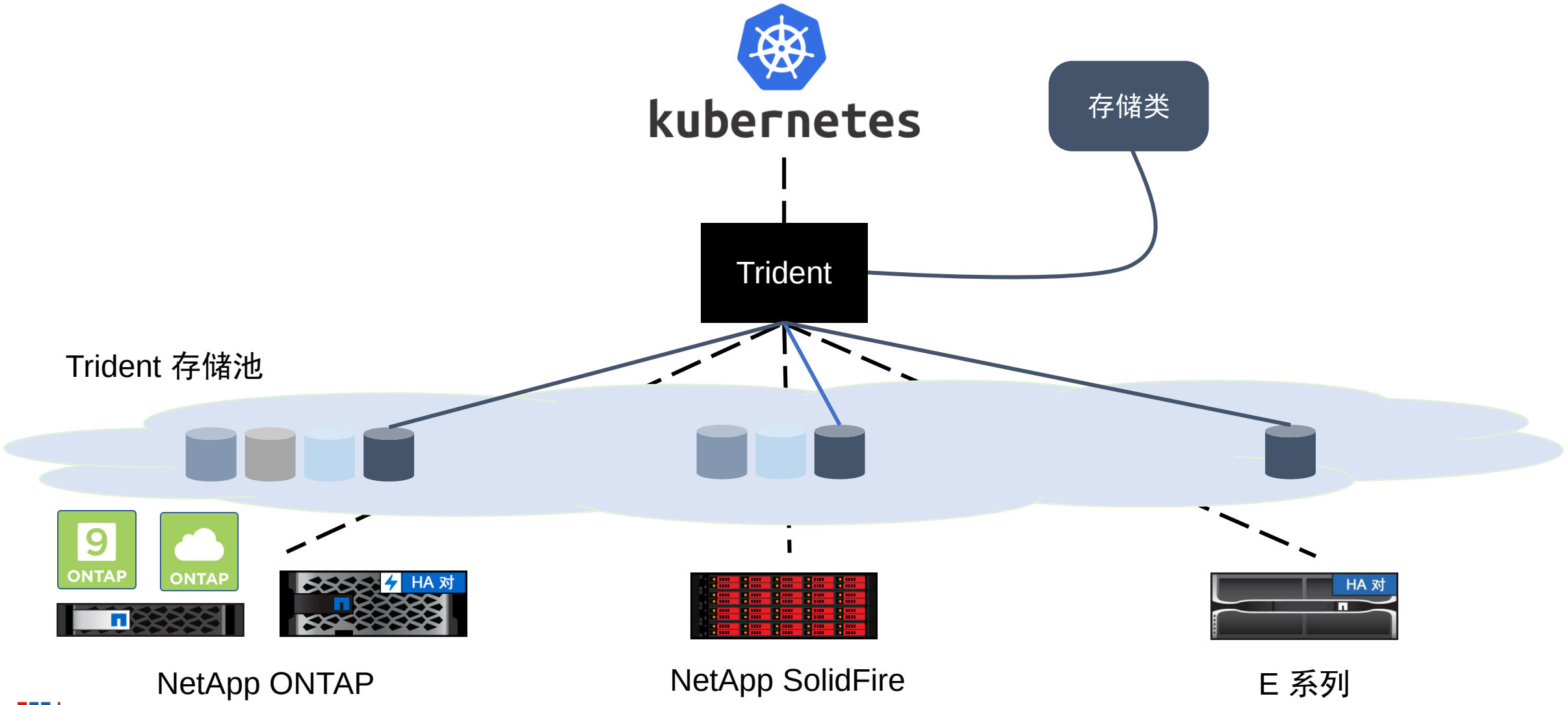
10

Trident - 容器存储解决方案



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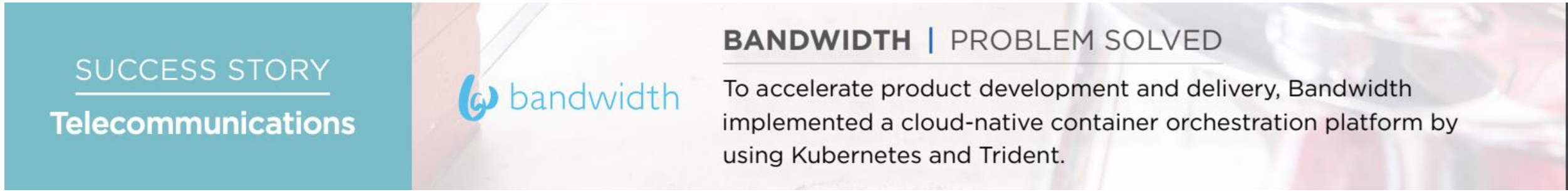
12

容器应用客户范例：加速产品发布

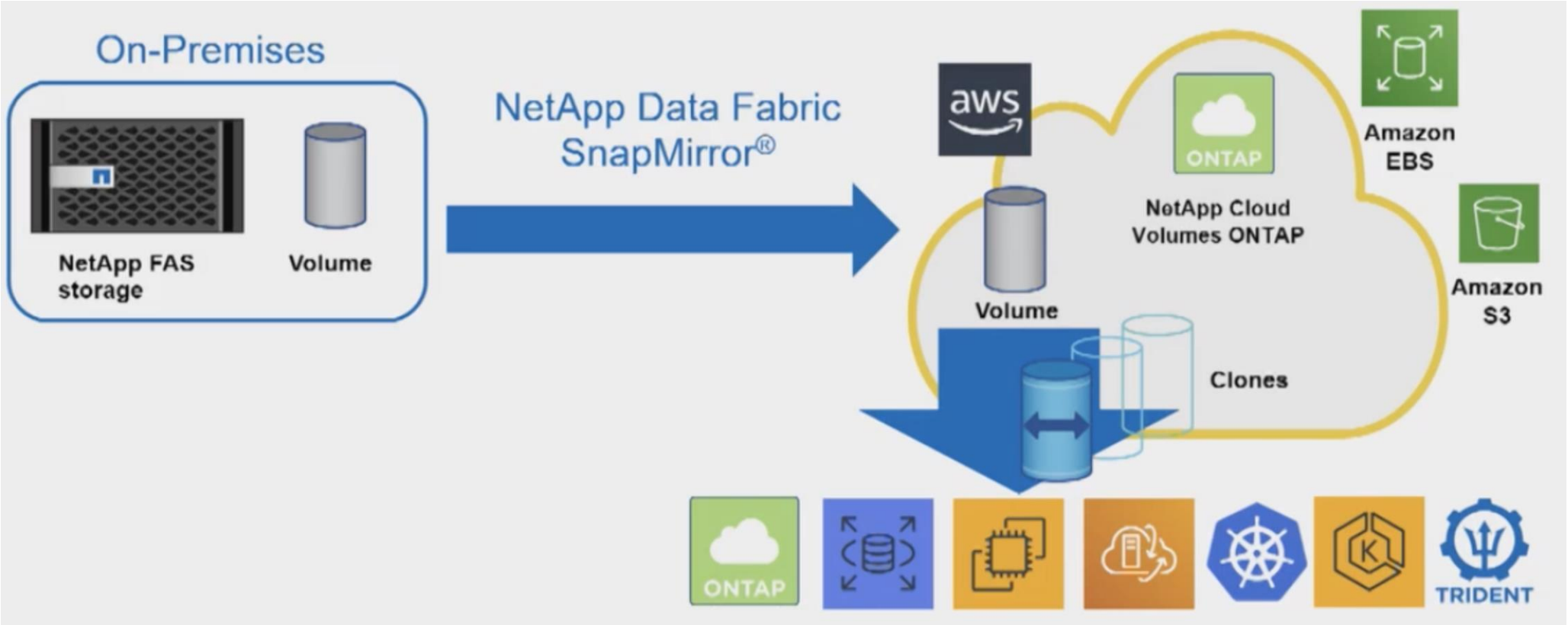


- 开发人员无需数周的准备，几分钟就可以访问容器、克隆环境，数据验证

Trident from NetApp enables persistent storage and automates storage provisioning, helping Bandwidth accelerate deployment and reduce friction between application owners and infrastructure teams.

https://customers.netapp.com/en/bandwidth-devops-case-study/ 客户案例

容器应用范例 :让数据产生价值



https://cloud.netapp.com/success-story-officeworks 参考案例

Officeworks

Lenovo NetApp

谢谢

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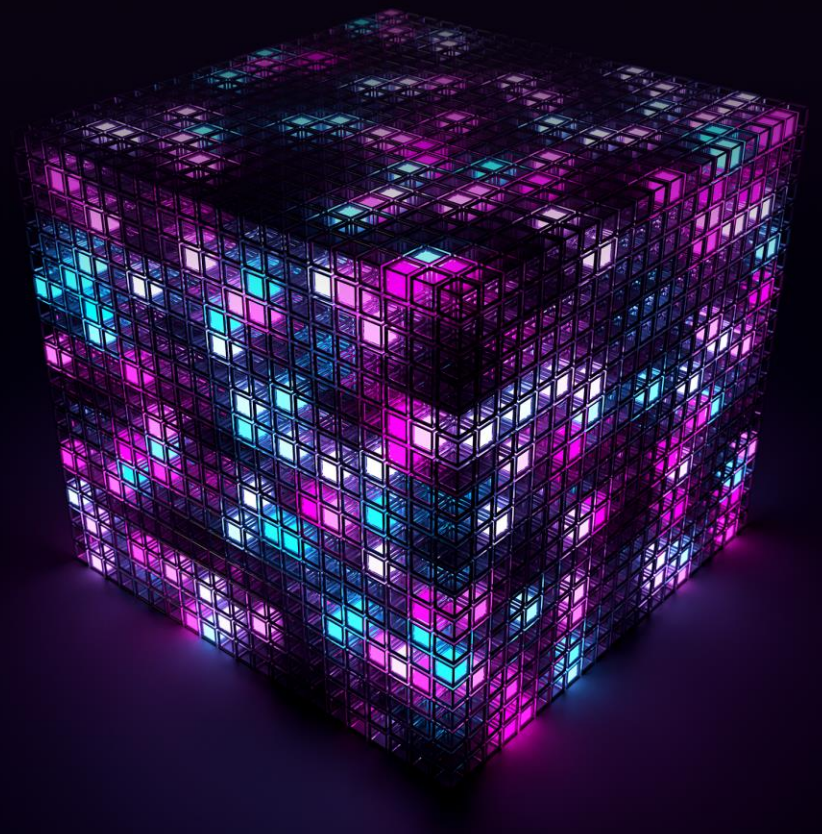

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16

演示环境介绍

搭建K8S+Trident环境

- Lenovo 笔记本（内存 >= 16G，Disk >= 30GB）+ VMware Workstation

- Ontap 9 Simulator

vsim-netapp-DOT9.5-cm_nodar.ova

- CentOS

CentOS Linux release 7.6.1810 (Core)

- K8S 版本

v1.16.4

- Trident

19.10.0

- Ontap 单节点集群(5 GB)
- 三台CentOS虚拟机

  k8s1， k8s2和 k8s3

2 GB or more of RAM per machine

2 CPUs or more

- K8S1为Master节点

kubectl get nodes

NAME	STATUS	ROLES	AGE	VERSION
k8s1.localdomain	Ready	master	13d	v1.16.4
k8s2.localdomain	Ready	<none>	13d	v1.16.4
k8s3.localdomain	Ready	<none>	13d	v1.16.4

Trident 安装流程

安装 Trident

- 下载 trident-installer-19.10.0.tar.gz并解压，进入trident-installer目录
- 执行安装

  ./tridentctl install -n trident
- 验证安装

  kubectl get pod -n trident

```
[root@k8s1 trident-installer]# ./tridentctl install -n trident
INFO Starting Trident installation.                 namespace=trident
INFO Created namespace.                             namespace=trident
INFO Created service account.
INFO Created cluster role.
INFO Created cluster role binding.
INFO Created custom resource definitions.           namespace=trident
INFO Added finalizers to custom resource definitions.
INFO Created Trident pod security policy.
INFO Created Trident service.
INFO Created Trident secret.
INFO Created Trident deployment.
INFO Created Trident daemonset.
INFO Waiting for Trident pod to start.
INFO Trident pod started.                           namespace=trident pod=trident-csi-64464dfb6-5vk2q
INFO Waiting for Trident REST interface.
INFO Trident REST interface is up.                  version=19.10.0
INFO Trident installation succeeded.
```

```
[root@k8s1 trident-installer]# kubectl get pod -n trident -o wide
NAME                          READY   STATUS    RESTARTS   AGE    IP              NODE
trident-csi-64464dfb6-5vk2q   5/5     Running   0          2m     10.244.2.2      k8s3.localdomain
trident-csi-bstsg             2/2     Running   0          119s   192.168.230.62  k8s2.localdomain
trident-csi-ffb2n             2/2     Running   0          119s   192.168.230.63  k8s3.localdomain
trident-csi-jg887             2/2     Running   0          119s   192.168.230.61  k8s1.localdomain
[root@k8s1 trident-installer]# kubectl get tridentnodes -n trident
NAME               AGE
k8s1.localdomain   2m
k8s2.localdomain   2m1s
k8s3.localdomain   2m1s
```

添加第一个Backend

- 创建backend.json文件，如示例
- 执行tridentctl create backend命令

  ./tridentctl create backend -n trident -f setup/backend.json
- 验证backend

  ./tridentctl get backend -n trident

```
{
    "version": 1,
    "storageDriverName": "ontap-nas",
    "backendName": " LN-Volume",
    "managementLIF": "192.168.230.51",
    "svm": "svm1",
    "username": "admin",
    "password": "root1234",
    "limitAggregateUsage": "90%",
    "nfsMountOptions": "nfsvers=3",
    "defaults": {
```

```
  "defaults": {
        "spaceReserve": "none",
        "exportPolicy": "myk8scluster",
        "snapshotPolicy": "none",
        "snapshotReserve": "0",
        "splitOnClone": "false",
        "unixPermissions": "777",
        "snapshotDir": "false",
        "securityStyle": "unix"
    }
}
```

```
[root@k8s1 trident-installer]# ./tridentctl get backend -n trident
+-----------+----------------+--------------------------------------+--------+---------+
|   NAME    | STORAGE DRIVER |                 UUID                 | STATE  | VOLUMES |
+-----------+----------------+--------------------------------------+--------+---------+
| LN-Volume | ontap-nas      | c5a68ef3-6e92-41db-9dbd-f0fb104bd0a5 | online |       0 |
+-----------+----------------+--------------------------------------+--------+---------+
```

Trident 深入实践

实践： Trident 后端和存储池

- 查看配置文件
  - 使用Qtree的后端类型 - 2000 vs 200,000
  - ontap-nas-economy
- 向 Trident 中添加后端
  - 添加使用Qtree的类型
  - tridentctl create backend
- 查看已发现的属性
  - 能正确识别
  - tridentctl get backend

实践：将存储类与存储池匹配

- 定义存储类
  - 使用卷
    - ontap-nas
  - 使用Qtree
    - ontap-nas-economy
- 使用 `tridentctl get storageclass <name> -o yaml` 可显示后端与功能之间的映射关系

实践：配置和使用存储

- 创建使用此 SC 的 PVC
- 验证存储卷
- 创建使用此 PVC 的模块
- 调整存储大小（直接扩展容器了使用的存储卷）
  - kubectl edit pvc

实践：存储回收

- 删除 PVC
- 验证是否已删除存储卷
- 是否在存储删除根据retainPolicy决定

实践：快照

- 充分利用Ontap高效的快照功能
- 创建快照存储类

  kubectl get volumesnapshotclass

- 基于源pvc创建快照

  目前不支持ontap-nas-economy类型

  kubectl get volumesnapshot

```
cluster1::> snapshot show -volume trident*
                                                          ---Blocks---
Vserver  Volume   Snapshot                                Size Total% Used%
-------- -------- ------------------------------------- -------- ------ -----
svm1     trident_pvc_0dbce066_fbd2_4c8a_9204_f0667b2fd21b
                  snapshot-5ab4d3ca-12bb-46fe-bd17-9e1046a0d1d3
                                                         152KB     0%   37%
```

```
apiVersion: snapshot.storage.k8s.io/v1alpha1

kind: VolumeSnapshotClass

metadata:

  name: csi-snapclass

snapshotter: csi.trident.netapp.io
```

```
apiVersion: snapshot.storage.k8s.io/v1alpha1

kind: VolumeSnapshot

metadata:

spec:

  name: v1

  kind: PersistentVolumeClaim
```

实践：克隆 – 来自现有快照

- Clone volume leverage Ontap FlexClone
- 创建PVC，通过dataSource控制

  dataSource:

  name: v1-snap

  kind: VolumeSnapshot

- 卷大小需和源卷一样

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: v1-clone-from-snap
spec:
  storageClassName: volume
  accessModes:
    - ReadWriteOnce
```

```
cluster1::*> snapshot show -volume trident*
                                                          ---Blocks---
Vserver  Volume   Snapshot                                Size Total% Used%
-------- -------- ------------------------------------- -------- ------ -----
svm1     trident_pvc_06104696_f53f_4e5d_86c3_852103822e2b
                  snapshot-5ab4d3ca-12bb-46fe-bd17-9e1046a0d1d3
                                                        164KB     0%   36%
         trident_pvc_0dbce066_fbd2_4c8a_9204_f0667b2fd21b
                  snapshot-5ab4d3ca-12bb-46fe-bd17-9e1046a0d1d3
                                                        168KB     0%   34%
                  20200222T135122Z                      136KB     0%   29%
3 entries were displayed.
```

实践：克隆 – 来自现有卷

- Clone volume leverage Ontap FlexClone
- 创建PVC，通过dataSource控制

dataSource:

name: v1

kind: PersistentVolumeClaim

- 卷大小需和源卷一样

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: v1-clone1
spec:
  storageClassName: volume
  dataSource:
```

```
cluster1::> snapshot show -volume trident*
                                                          ---Blocks---
Vserver  Volume   Snapshot                                Size Total% Used%
-------- -------- ------------------------------------ -------- ------ -----
svm1     trident_pvc_0dbce066_fbd2_4c8a_9204_f0667b2fd21b
                  snapshot-5ab4d3ca-12bb-46fe-bd17-9e1046a0d1d3
                                                        168KB     0%   36%
                  20200222T132721Z                      212KB     0%   42%
         trident_pvc_82e40a66_3828_42e3_b295_15856f6a718d
                  20200222T132721Z                      216KB     0%   36%
3 entries were displayed.
```

```
  storage: 1Gi
```

实践：迁移、导入

- 平滑迁移到容器环境，支持容灾
- 支持把已有的卷导入K8S环境
  - 支持ontap-nas
  - 支持ontap-nas-flexgroup,
  - 支持solidfire-san
- 轻松迁移、实现容灾
- 全自动管理
  - tridentctl import volume <backendName> <volumeName_on_storage> -f <path-to-pvc-file>
- 不自动管理（推荐）
  - tridentctl import volume <backendName> <volumeName_on_storage> -f <path-to-pvc-file> --no-manage

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: volimport
  namespace: default
spec:
  accessModes:
  - ReadWriteOnce
  storageClassName: volume
```

Lenovo NetApp

谢谢

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